

MY FAVORITE
lesson

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Teaching the Pythagorean Theorem for Understanding

One of my favorite lessons was developed not by me but by a group of student teachers. While conducting research on student teaching in mathematics classes at a Japanese junior high school, I observed a group of seven Japanese student teachers participate in a lesson study to develop a lesson on the Pythagorean theorem. The goal of the lesson was for the students to understand the meaning of the theorem. The student teachers looked in many textbooks, studied the different proofs of the theorem, and consulted their cooperating teachers.

One afternoon, the student teachers were presenting the current version of their lesson to the cooperating teachers and discussing the pros and cons of what they had done. Taking some card stock, one of the cooperating teachers sketched a portion of one of the proofs of the theorem in which the squares built on the legs of the right triangle are placed next to each other (see fig. 1). In this particular sketch, he happened to make the ratio $a:b = 1:3$.

He then cut out these five pieces, called the student teachers around him, and asked them to use all five pieces to build one square. They were able to build the original two squares like the

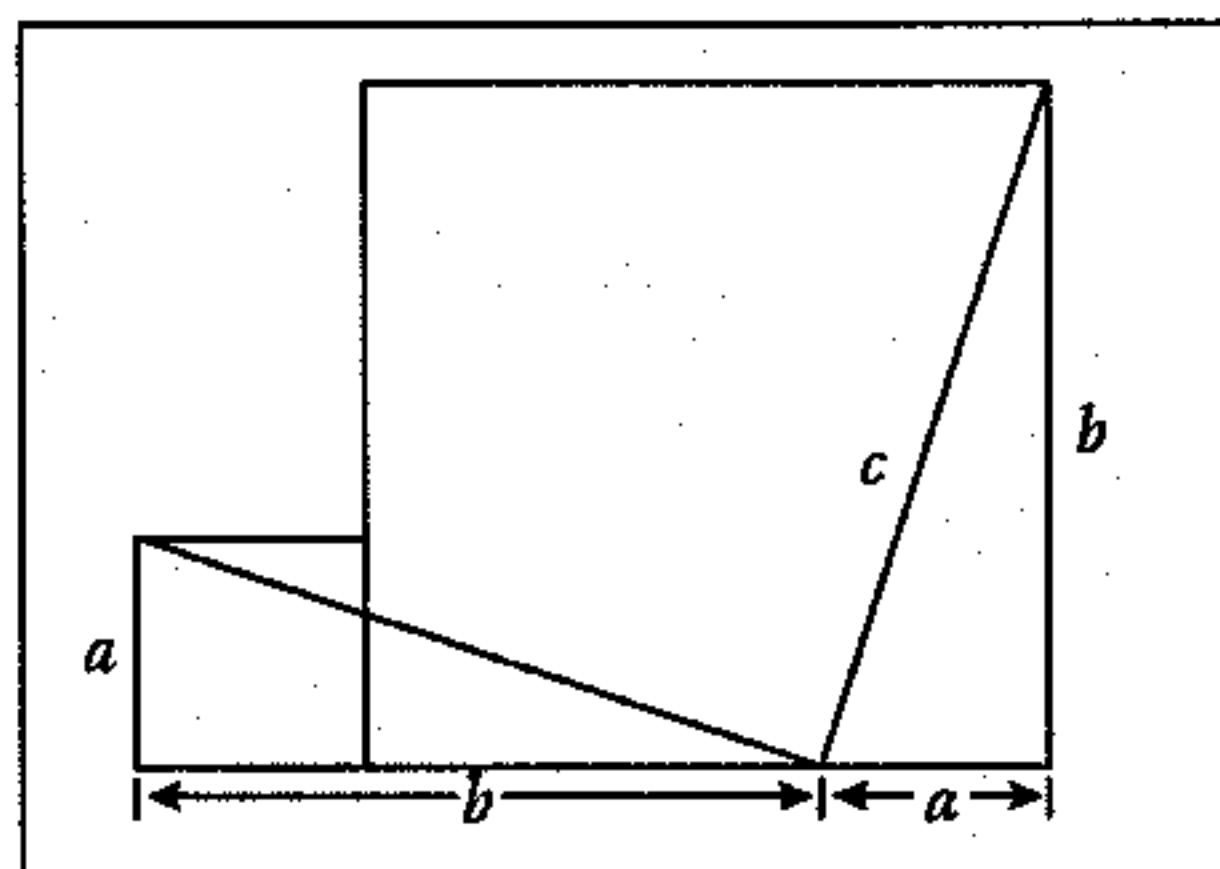


Fig. 1 The two squares built from the legs of a right triangle can be placed next to each other.

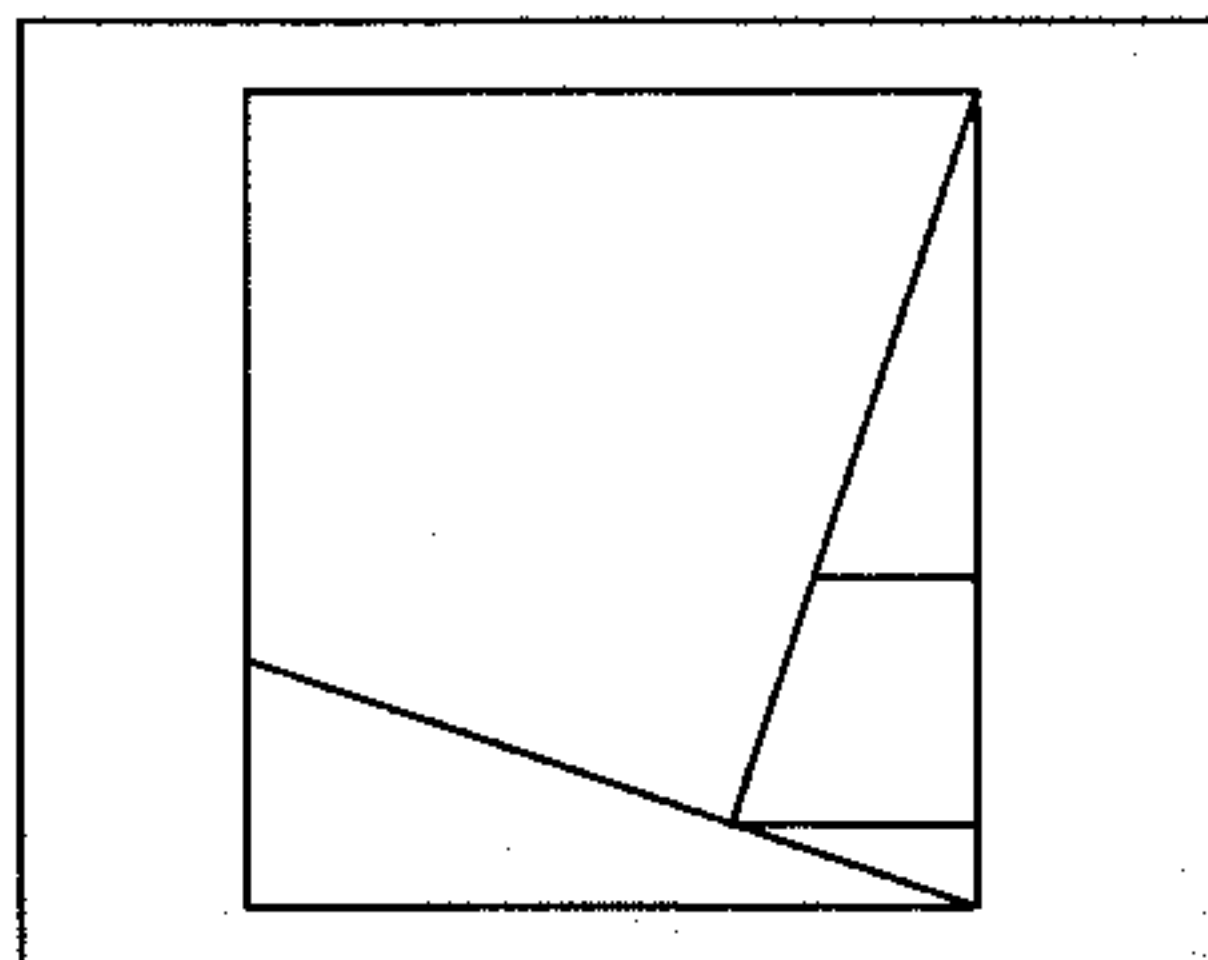


Fig. 2 Students at first think that this arrangement produces a square.

ones in figure 1 but struggled to make one square. They finally made what they thought was a square (see fig. 2), but, on further investigation, determined that it was a rectangle, not a square. The particular ratio of a to b seemed to lend itself to the rectangle in figure 2, which looks like a square. After about ten more minutes of investigation, the student teachers were able to use all five pieces to make one square (see fig. 3). This task became the task for their own lesson.

The student teachers built their lesson around this task in the following way. Students were grouped in pairs, given these five pieces, and asked to construct one square. Like the student teachers, the students also found the two squares of area a^2 and b^2 and the rectangle in figure 2 that they thought was a square. They were given a right triangle with legs of lengths a and b to use as a measuring device to determine whether the shape they had constructed was, in fact, a square. By the time the students found the square, they were comfortable with the fact that the same five pieces could make two squares of area a^2 and b^2 or one square of area c^2 . They also recognized the connection between the right

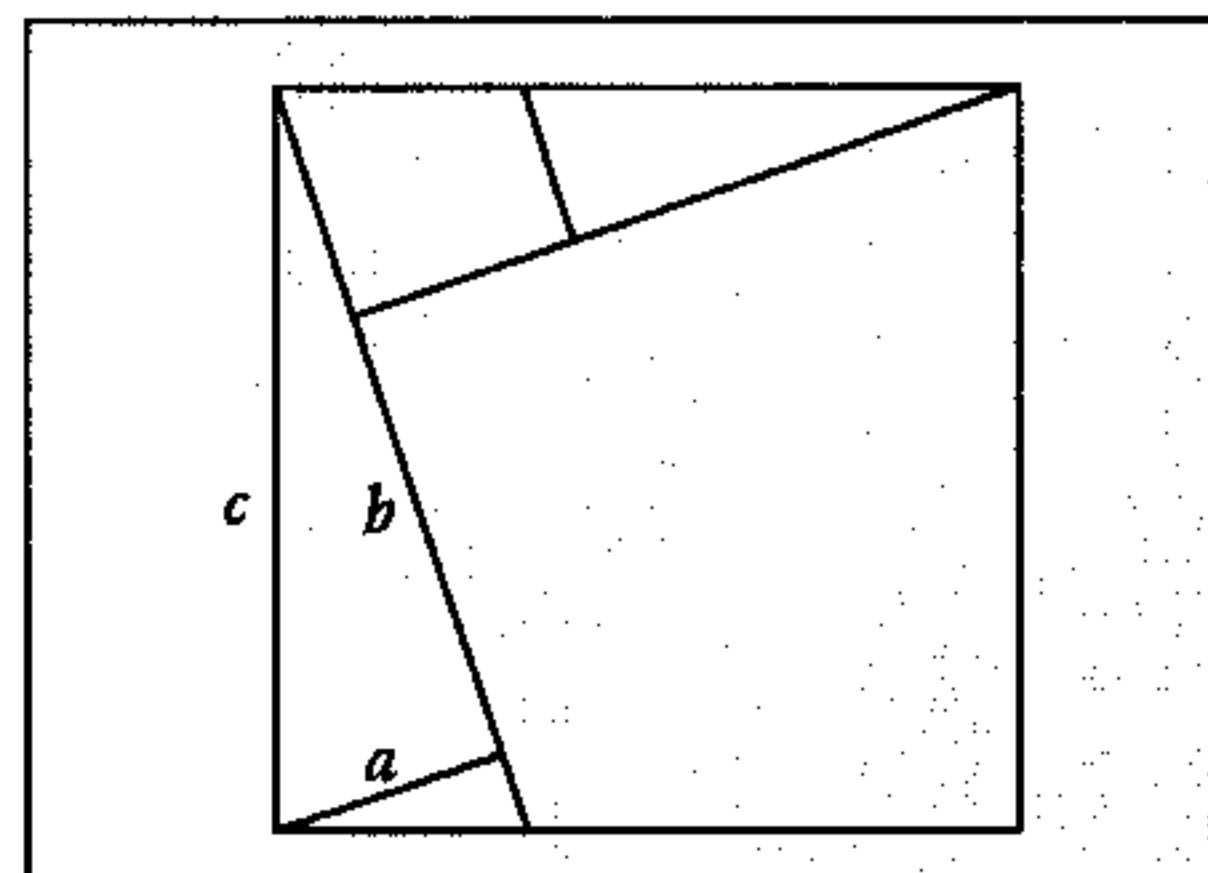


Fig. 3 Juxtaposing all five pieces demonstrates the Pythagorean theorem.

triangle that they had been given and the dimensions of the squares that they had built. The students made the connections and better understood the meaning of the Pythagorean theorem.

Since returning from Japan, I have used this lesson many times with many different groups of students—from high school geometry students to preservice mathematics teachers—and the results are always the same: Students gain a greater understanding of the Pythagorean theorem.

"The Back Page" provides a forum for readers to share a favorite lesson. Lessons to be considered for publication should be submitted to mt.msubmit.net. Lessons should not exceed 600 words and are subject to abridgment.

